INSTRUCTION MANUAL

*Sensitive Research**

THERMO-COUPLE
INDICATING INSTRUMENTS

MODELS A-AU-AUV-RF-XT

Gertsch
EMPIRE
Sensitive Research
Panoramic

SINGER

*A Trademark of THE SINGER COMPANY

Precision electrical and electronic instruments for measurement

THE SINGER COMPANY • METRICS DIVISION

PLACE
STAMP
HERE

THE SINGER COMPANY
METRICS DIVISION
915 Pembroke Street
Bridgeport 8, Conn.

OPERATIONAL AND MAINTENANCE PROCEDURE

FOR

THERMO-COUPLE INDICATING INSTRUMENTS

MODELS A - AU - AUV - RF - XT

INITIAL INSPECTION

Upon receipt, your instrument should be carefully unpacked and examined for any visible external damage, i.e., split case, cracked glass, broken binding posts, etc. Place the instrument on a reasonably level bench. If the instrument has a wire shorting the terminals, it should be removed. Turning the mechanical zero adjuster, move the pointer both above and below the zero line of the scale. It should have sufficient travel to go a little beyond zero in each direction. Set the pointer exactly on zero while lightly tapping the instrument case with your fingers. The pointer will be correctly adjusted for zero when no reflection of the pointer's knife edge can be seen in the anti-parallax mirror, and the pointer is zeroed.

TEST FOR BALANCE

Balance requirements differ for our various types of instruments. The general testing procedure for balance on all models is the same, the difference being only in the degree of angle that the instrument is tipped from a horizontal position.

1. Set the pointer exactly on its zero position.

2. Now tip the instrument slowly from the side farthest from you to an angular position as shown on the table below.

3. Next, lay the instrument flat again and then tip it on its left side and tap gently.

In both these procedures the instrument should be within its balance specifications. In general, these specifications are as follows:

MODEL	ACCURACY	ANGLE FROM HORIZONTAL	BALANCE GUARANTEE
A (Thermal) RF - XT (Thermal) AU - AUV (Thermal) JWTC (Thermal) University (Thermal)	.5 of 1%	15^{o}	.5 of 1%

FRICTION TEST

The instrument may be tested for friction by connecting it to a suitable source of power and deflecting it at least 25% of full scale, reducing the deflecting current to zero. No instrument should be accepted for use if the pointer does not return within .1 of a division from zero. Be sure that your controls operate smoothly so that there will be no false indication of the pointer's sticking.

CARE AND MAINTENANCE

Caution - Disassembly of the movement should not be attempted unless a skilled instrument man and calibration and scale drawing equipment are available.

Good practice dictated that periodic checks be made for pivot friction, balance, and scale calibration.

If the instrument glass is cleaned, the task should be completed by heavily breathing upon it to dissipate any electrostatic charges that may have been generated by friction. Occasionally, the binding post's metal contact surfaces should be cleaned and brightened by the careful use of a fine sandpaper.

The instrument case may be cleaned by using carbon tetrachloride to dissolve any greasy surface accumulation. A brisk rubbing with a soft flannel cloth will restore moulded cases to their original lustre. Should the engraving "white" become discolored, it can be removed with a sharp point and refilled with a white wax crayon material.

OPERATIONAL PROCEDURE

1. Place the instrument on a level surface so that it is NOT more than 50^{o} from the horizontal.

2. In good instrument practice, the instrument should be kept away from any source of very strong magnetic fields. Maximum tolerable field 5 oersteds.

3. Set the pointer on zero.

4. For safety, it is best to turn off the current or voltage to be measured before making connections to any instrument.

5. Apply power and read the deflection when the instrument pointer comes to rest.

CALIBRATION CHECK

No actual calibration check should be made until the instrument has become thoroughly temperature saturated at the standard temperature (25^{o}C) for at least four hours.

1. The deflection of the instrument is proportional to the RMS value of the applied voltage. Within its frequency range it is unaffected by wave form distortion.

2. To check on AC, apply voltage or current at the input terminals and read the instrument deflection directly. To check on DC, install a low resistance reversing switch in the circuit and take the average of reading with each polarity. (The average of two DC readings must be taken to obtain a "true reading".)

Note - For information specific to this instrument, see the data card attached to the instrument case.

VERY IMPORTANT INFORMATION

THERMOCOUPLE OVERLOADING

All vacuum thermocouple instruments irrespective of their maker, will not stand overloads over 100% without damage to the thermocouple unless protected.

A special precaution which should be taken by the user of thermocouple instruments is to avoid opening the primary circuit of a transformer whose secondary circuit is being measured by thermocouple instruments.

The reason for this is, that the transformer as an energy storing device, may, under certain conditions, discharge its energy into the secondary circuit, thereby overloading the thermocouple instruments. This danger can be eliminated by either disconnecting the instrument from the secondary circuit before opening the primary circuit or by including a Variac in the primary circuit so that the excitation of the primary may be reduced to zero before switching off.

Some of our thermal instruments with the exception of the models RF -XT and University have a finger operated safety push button. Its operation is described below:

"SAFETY SHUNT" THERMOCOUPLE OVERLOAD PROTECTION

A manually operated "Push Button" system can be incorporated in thermocouple instruments for protection against overloads of up to 1000%.

When the push button is in its normal position for maximum protection the thermocouple is shunted. A red line marked "Safety" is drawn at the 20% point on the instrument's scale (See illustration). An overload is indicated if the pointer deflection is above the red line. If the pointer is at or below the red line, the push button can be depressed for an exact reading. The protection system is compensated so that its operation does not change the loading of the external circuit.

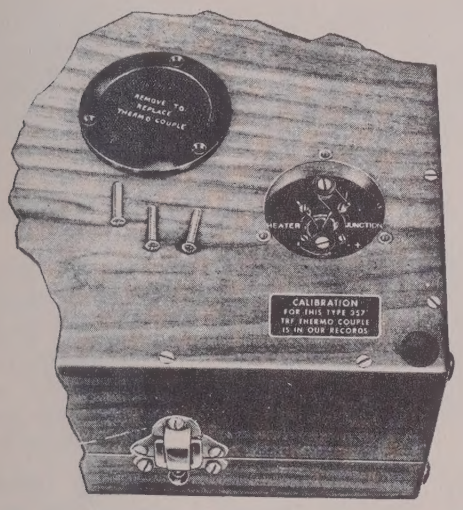
The Safety Shunt comes as standard equipment in the Models USP, U - SP and U88, and is included in their price. It is available for installation as an accessory item in most portable and rack mounted edgewise panel type thermocouple instruments. (If rack mounting is not specified, the safety shunt system is incorporated in the instrument and the push button is supplied separately for installation by the user in his own panel). It is excluded from University Models and other specific types as noted in their descriptions in this literature.

REPLACEMENT THERMOCOUPLES

Replacement thermocouples are available for all Sensitive Research thermal instruments. However, unless an instrument has a TYPE 357 Thermocouple Replacement Feature, a replacement thermocouple is not guaranteed to either match the linearity of the original instrument scale or be within the original accuracy specifications of the instrument.

THE TYPE 357 THERMOCOUPLES

The TYPE 357 Replacement Feature allows field replacement of overloaded or burned out thermocouples with the retention of full instrument accuracy. All currently supplied Models USP, U - SP, and U88 have this feature as standard equipment and it is available as an optional feature in the Model A and most Model AEW instruments. It is not available for any other instrument model but can be incorporated into any older version of the above instrument models.



This new Type 357 replacement feature is available on new instruments at an additional cost of $30.00. Replacement couples will ordinarily be shippid in a few days. The cost of any Type 357 replacement couple is $60.00 each.

Thermocouple Replacement Feature now available for Type EW panel mounted instruments. Price $40.00. A manual is available from us (cost $2.00) describing in detail the method of replacing Thermocouples and checking the calibration.

IDENTIFYING THE TYPE 357 THERMOCOUPLE

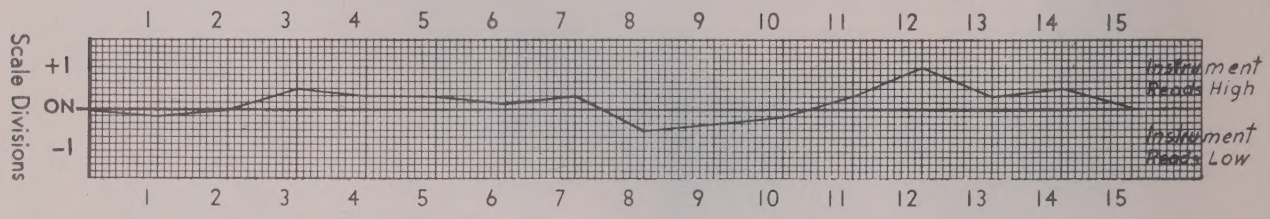
Instruments for which the type 357 replacement couple can be supplied are identified by the presence of a black and silver metallic label adjacent to the removable black bakelite thermocouple cap. The label signifies that a calibration record of the millivolt output of the original thermocouple is on file. In order to be assured of original accuracy, it is recomended that existent thermocouple replacement feature instruments which do not bear this TYPE 357 metallic label be returned to Sensitive Research for modification.

THERMOCOUPLE ORDERING INFORMATION

Replacement thermocouples are obtained by specifying "Replacement Thermocouple for instrument #(give serial number)." The serial nember of an instrument is absolutely necessary in order to provide the proper thermocouple. TYPE 357 thermocouples are supplied with two resistors and a correction chart. The resistor in series with one of the black thermocouple leads is used to bring the thermocouple heater resistance up to standard value. The second resistor is in series with the green junction lead, and is used to adjust full scale sensitivity. Care should be used to install the

new thermocouple and its associated resistors exactly as the original was connected. A typical correction chart for the TYPE 357 replacement thermocouple is shown below:

DIVISION ERROR IN INSTRUMENT READING

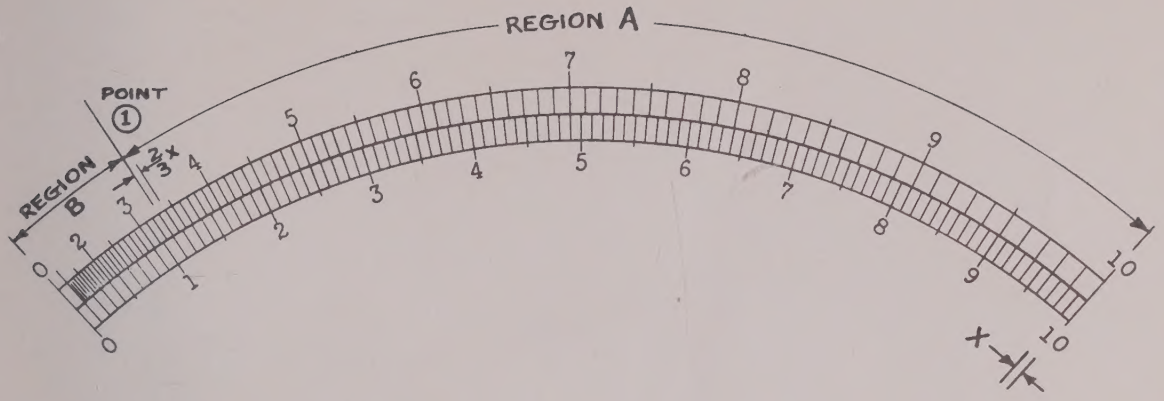


"THE STATED ACCURACY ONLY APPLIES IN THOSE PORTIONS OF THE SCALE WHERE THE DIVISIONS ARE EQUAL TO OR GREATER THAN TWO-THIRDS THE WIDTH THEY WOULD BE IF THE SCALE WERE EVENLY DIVIDED. IN OTHER PORTIONS OF THE SCALE, THE ALLOWABLE LIMIT OF ERROR WILL BE A DISTANCE EQUAL TO TWO-THIRDS THE TOTAL SCALE LENGTH MULTIPLIED BY THE RATED ACCURACY (EXPRESSED AS A DECIMAL)."

For non-linear scales, above and below this point they actually have two different definitions of accuracy. In the Region A above the point where the 2/3 size division occurred, the accuracy is a direct percentage of the full scale reading. Simplifying further, and assuming full scale equal to 10, for a 1/2% accuracy instrument, the accuracy at any point in Region A only, is ±1/2 of one division regardless of the size of that division.

When we consider Region B of the scale, they change the definition of accuracy to a fixed scale distance rather than having the accuracy related to the constantly changing divisions. In this Region (B) the accuracy is defined as an exact allowable mechanical deviation rather than a percent of division. This allowable deviation is taken to be the same mechanical error as is allowed at point (1), regardless of how large this may be in terms of the electrical quantities involved.

In summary then, throughout Region A we are allowed a fixed percentage of the electrical full scale value being measured, while throughout Region B we have a fixed mechanical amount of error allowed regardless of the electrical quantities involved.



EXAMPLE: In the above illustration, in which are drawn two scales and assuming a 1/2% instrument, the division on the nonlinear scale which is 2/3 the size of one of the linear divisions, is at 33 divisions (3.3reading). Thus on this scale the guaranteed accuracy would be 1/2% of the full scale value for readings from 3.3 to 10. From 3.3 down to zero, the accuracy is .005 x 6.3"x 2/3 = .02". That is, the pointer will be within .02 inch of the correct position rather than an exact percentage of the full scale value read (assuming a 6.3 inch scale length).

WARRANTY

THE SINGER COMPANY, METRICS DIVISION, warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

*Commander** Instruments: Potentiometers, Bridges, Volt Ratio Boxes and Standard Resistors.....5 years

*Sensitive Research** Electrical Indicating Instruments.....2 years

Other Electrical and Electronic Measuring Instruments.....1 year

Repair or replacement (at our option) without charge (F.O.B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuzes, lamps, thermoelements, and *RatioTran** potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

If the instrument or any portion thereof, has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

This warranty is in lieu of all other obligations or liabilities expressed or implied and The Singer Company neither assumes, nor authorizes any person to assume for them, any other liability in connection with sales of instruments manufactured by The Singer Company, Metrics Division.

THE SINGER COMPANY • METRICS DIVISION

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REPAIR AND MAINTENANCE

Instruments should be returned only on prior written authorization from the Singer Representative or the factory(1). Warranty repair will be made upon written request. Please provide the following information in order to expedite our processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(2)
4. Test instruments used
5. Approximate date instrument was placed in operation
6. Approximate number of hours of use
7. Has maintenance action been previously requested?
8. Other comments

Upon receipt of this information our Service Department will send you service data or shipping instructions. Upon receipt of shipping instructions forward the instrument to the factory prepaid. If requested, an estimate of charges will be made before work begins.

(1) Contact Metrics Division, Bridgeport, Connecticut for *Commander**, *Empire**, *Panoramic**, and *Sensitive Research** instruments. Contact Metrics Division, Los Angeles, California for *Gertsch** instruments.

(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.